Modular Stabilised Power Supply
PMD18-1 Handbook

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INTRODUCTION SECTION 1

The PMD18-1 is a Power Module with two output channels.

These channels will supply 18V dc at current ratings up to 1A and are fully variable down to 1 Volt by voltage potentiometers on the front panel.

Both channels are constant voltage and current stabilised using a Monolithic voltage and current regulator with silicon series pass transistors.

There are facilities for external voltage and current programming.

Input Voltages

100, 105, 110, 115, 120, 125V ac
200, 210, 220, 230, 240, 250V ac
All ± 10% and at a frequency of 48-450 HZ

Output Voltage and Current	Channel A	Channel B
Output Voltage	1-18V	1-18V
Output current	0-1A	0-1A

Line Voltage Regulation (Constant Voltage Mode)

Less than 0.03% + 3mV. Typically 0.015% + 1mV
for a total change of ± 10% of supply voltage

Load Voltage Regulation (Constant Voltage Mode)

Less than 0.03%mV, Typically 0.015% + 1mV
for a 0-100% load current change

Ripple

Less than 1mV p-p at full load

Temperature Coefficient

Typically 0.01% / ^{O}C

Load Current Regulation

0.2% + 1mA d.c. (for a 0-100% load voltage change)

Operating Temperature Range

0^{O}C to + 60^{O}C ambient

Output Impedance

Less than 0.25Ω at 100 KH_z

Remote Programming Facility

Voltage Programming :-
Programming resistance 1000Ω/V ± 2%
Current Programming :-
Programming resistance 430Ω for 100% output current ± 10%

Protection

Constant current overload protection which is set to 1.05A ± 2% variable by an internal resistor change.

Insulation

Potentials applied to the output terminals must not exceed ± 250V dc relative to earth.

Insulation between supply input and earth, and between supply input and output, not less than 10MΩ at 500V d.c.

Dimensions and Weight

Table 1. Dimensions and Weight

Width		Height		Depth		Weight	
m.m	in	m.m	in	m.m	in	Kg	lb
50	1.96	130	5.13	228	9	2.73	6

3.1 Installation

The power module is secured in position by two fixing screws on the underside or four screws on the side.

The fixing centre data is shown in figure 2

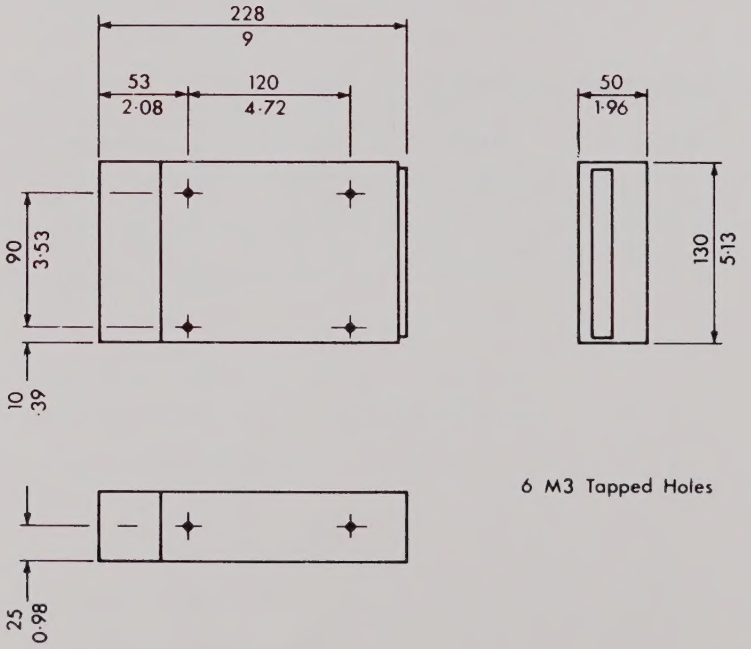


Fig. 2 Fixing Centres

3.2 A.C. Supply

Before connecting the unit ensure that the connections to the primary of the supply transformer T1 corresponds to the voltage of the local supply, and that the supply fuse F1 is correct for the input voltage range.

(see Table 2 below)

Table 2. Fuse Ratings

F.1		F.11, F21
Fuse Rating 200 - 250v	Fuse Rating 100 - 125v	D.C. Fuse
1A H.R.C.	2A H.R.C.	2.5A H.R.C.

The primary connections of T1 should be paralleled when local supply is 100 to 125V Figure 3 shows the connections for 110V supply and Table 3 gives the connections for supplies between 100 and 125V

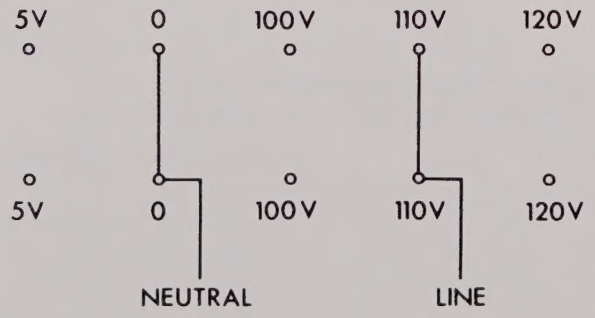


Fig. 3 Transformer Primary Connections for 110V

Table 3. Transformer Primary Connections 100 - 125V

Supply	Neutral	Line	Neutral Link Between	Line Link Between
100V	0	100	0 - 0	100 - 100
105V	5	100	5 - 5	100 - 100
110V	0	110	0 - 0	110 - 110
115V	5	110	5 - 5	110 - 110
120V	0	120	0 - 0	120 - 120
125V	5	120	5 - 5	120 - 120

When a 200 to 250V supply is available, the primary connections of T1 should be made in series. Figure 4 shows the series connections to be made for a 240V supply and Table 4 gives the connections for supplies between 200 and 250V

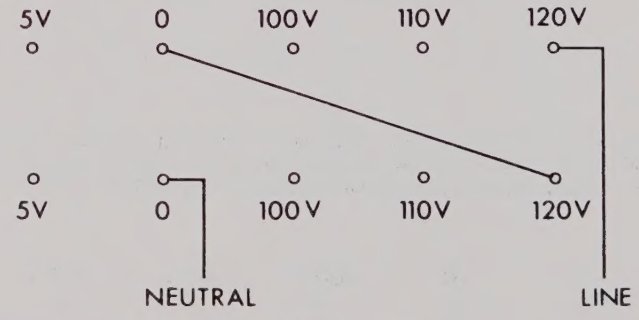


Fig. 4 Transformer primary Connections for 240V

Table 4. Transformer Primary Connections 200 - 250V

Supply	Neutral	Line	Diagonal Link Between
200	0	100	0 - 100
210	5	100	5 - 100
220	0	110	0 - 110
230	5	110	5 - 110
240	0	120	0 - 120
250	5	120	5 - 120

3.3 Setting Output Voltage and Current

3.3.1 Voltage Setting

The output voltage for each channel is set by the adjustment of a multi-turn potentiometer on the front panel.

3.3.2 Current Setting

The maximum output current on each channel is preset to 1.05A ± 2%. If however the equipment being supplied could be damaged by the output current available from either channel the maximum current can be reset to a lower level by replacing R.110 or 210, R.106 or R.206 on the main P.C.B. A.O.T. resistor R.106 or R.206 being used for fine setting of the output current.

When resetting the output current ensure that the unit is working clear of the knee area of the voltage current characteristic (See fig 5) by setting the short circuit current 5% more than the working current.

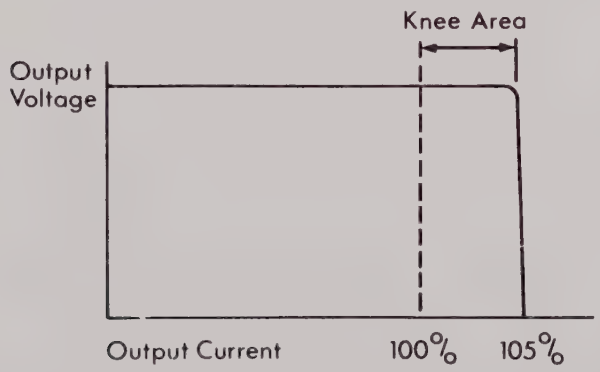


Fig. 5 Voltage Current Characteristic

3.3.2.1 Resetting the Output Current

To reset the output current proceed as follows:-

1. Remove the A.C. supply.
2. Remove the side cover.
3. Remove R.110 or R.210, R.106 or R.206 on the main Printed Circuit Board and replace with the appropriate resistor (5) (see section 2 for value).
4. Reconnect the A.C. supply and switch on.

3.4 Remote Programming

Voltage and current may be controlled externally by removing the links or resistors described and using external resistors.

3.4.1 Voltage Control

To connect the unit for external programming for either channel proceed as follows:-

1. Remove the AC supply.
2. Remove the negative sense link.
3. Connect the programming resistor between negative and external programme terminals (PR) on front panel.
   (See section 2 for value)
4. Reconnect the AC supply and switch on.

3.4.2 Current Control

To connect the unit for external programming proceed as follows:-

1. Remove the AC supply.
2. Remove Side Cover.
3. Remove on main Printed Circuit Board. R.110 or R.210, R.106 or R.206.
4. Use a pair of connecting leads from R.110 terminals to the external resistor.
   (See section 2 for value)
5. Reconnect the AC supply and switch on.

NOTE

When connecting leads are used for voltage on current programming they should be shielded from stray electromagnetic fields to minimise 'noise' pick-up.

3.5 Parallel and Series Operation

The outputs of the module may be operated in parallel and should be connected as shown in figure 6. For best voltage regulation the terminals labelled 'P' on the front panel should be connected together and four terminal sensing used, but this is not essential (see figure 7).

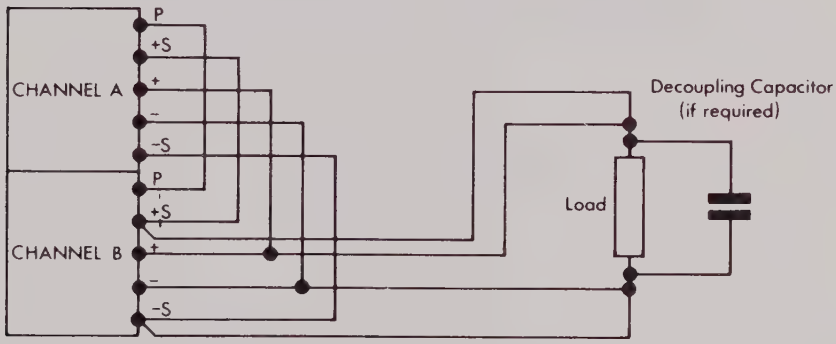


Fig. 6 Parallel Operation

Channel A & B may be connected in series. Further units may be connected in series but total voltage must not exceed 250V D.C.

3.6 Four Terminal Sensing

Where long external output leads are used, four terminal sensing is provided to enable the load voltage regulation of the power supply to be maintained at the load connections.

3.6

The two links between the + ve O/P and + ve sense and the - ve O/P and the - ve sense terminals should be removed and connections made as shown in figure 7. These output connections should be run together and a decoupling capacitor similar to C105 or 205 in the power supply, connected at the load terminals if the high frequency output impedance is to be maintained. Parallel connections should be made as shown in figure 8.

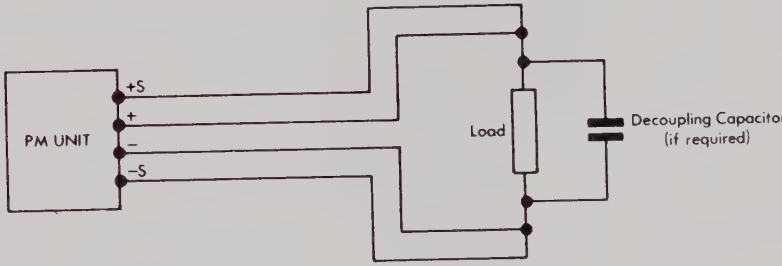


Fig. 7 Four Sensing Terminal

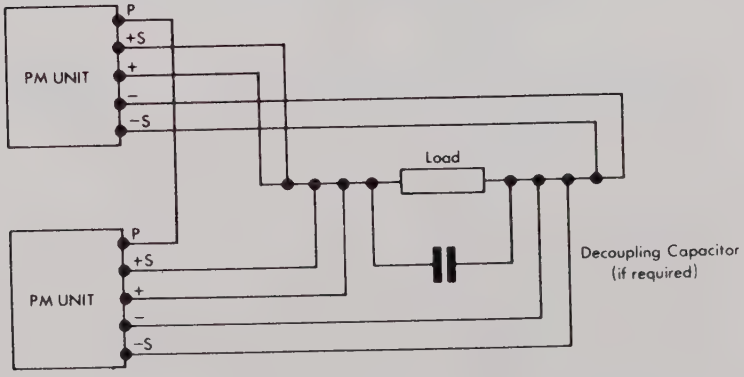


Fig. 8 Four Terminal Sensing (Parallel)

The maximum permissible voltage drop in the external leads when using four terminal sensing is 0.5V total in both leads i.e. 0.25V in each lead +ve and -ve or 0.5V in one supply lead with a negligibly low resistance earth return.

The total permissible length of lead for 0.5V drop is listed in Table 5 for various wire sizes and current ratings. Note that this is the total permissible loop length "go and return" and that the power supply can only be situated at half this distance from the load for a two wire +ve and -ve lead system.

Table 5. Permissible lead length for 4-terminal sensing

Wire Size	Lead Length	
	mtrs	feet
7/.0076	5.8	19
14/.0076	11.6	38
23/.0076	18.2	60

NOTE

The operations for the A channel and the B channel in the power supply are identical; hence they are not described separately.

4.1 General

The circuit of the power module consists of five main sections as shown in Figure 9.

These provide rectification and smoothing of the a.c. supply, regulation, automatic control of the output voltage and protection of the regulator transistors against over load.

With the exception of the transformer; each section is duplicated in the unit for the B channel.

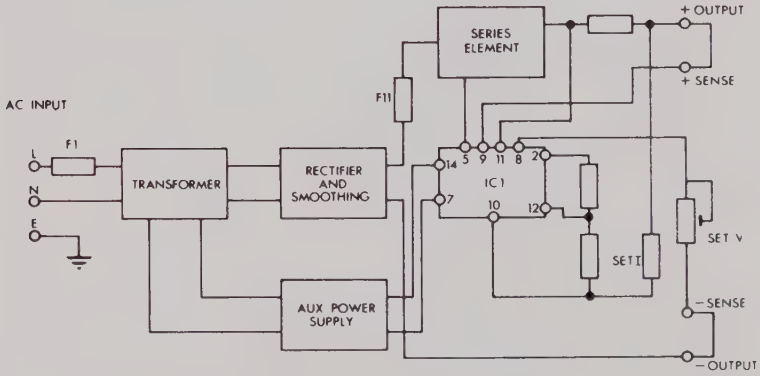


Fig. 9 Functional Diagram

4.2 Supply Rectification and Smoothing

The a.c. input is applied to the appropriate section of the primary winding of T.1. through the supply input adjusting links and F1. The output from the secondary T1 is rectified by D11-14 and smoothed by C11. This smoothed row d.c. is then applied via F11 to the collector of the regulator transistor TR11.

A further secondary winding on T1 is rectified by D101, and D102 and smoothed by C.101 to give a 25V d.c. auxiliary to drive the internal regulator of IC101.

4.3 Voltage Control

A reference current source is generated in the integrated circuit IC101.

This current flows through R.101 and produces the required voltage across the voltage setting potentiometer R.113 in accordance with the output voltage required.

The voltage across R113 is compared with the output voltage. If there is a rise in output voltage, the effect of the voltage amplifier in IC101 will be such as to reduce the drive to TR11 via TR101, hence counteracting the original rise in the output voltage.

Diodes D103 to D106 protect the voltage and current control amplifiers in IC101 against transient voltages, while D107 protects the output of IC101 against high voltage if series element TR11 fails.

4.4 Current Control

A voltage is developed across R103 which is directly proportional to the output current. Also current flows from pin 12 on the integrated circuit IC101 via R.102 producing a voltage across current setting resistor R.110 which in constant voltage mode nullifies the effect of the current amplifier.

When the voltage across R.103 equals that across R.110 the current amplifier takes over control from the voltage amplifier.

If the output current tends to fall the voltage across R.103 will also fall and since the voltage across R.110 is constant the current amplifier will have the effect of increasing the drive to TR101 and hence allowing more current to flow through TR11 so counteracting the original fall in current.

5.1 Access to Components

All components are accessible after removing the side cover held by six fixing screws.

5.2 Replacement Servicing

Replacement of Printed Circuit Boards

Control Board. Advance Part No. 60999
Transformer Board. Advance Part No. 61005

5.3 Fault Finding

Determine the state of the output voltage on load and proceed as outlined in Table 6.

The procedure for channel B in the module is identical to that of channel A.

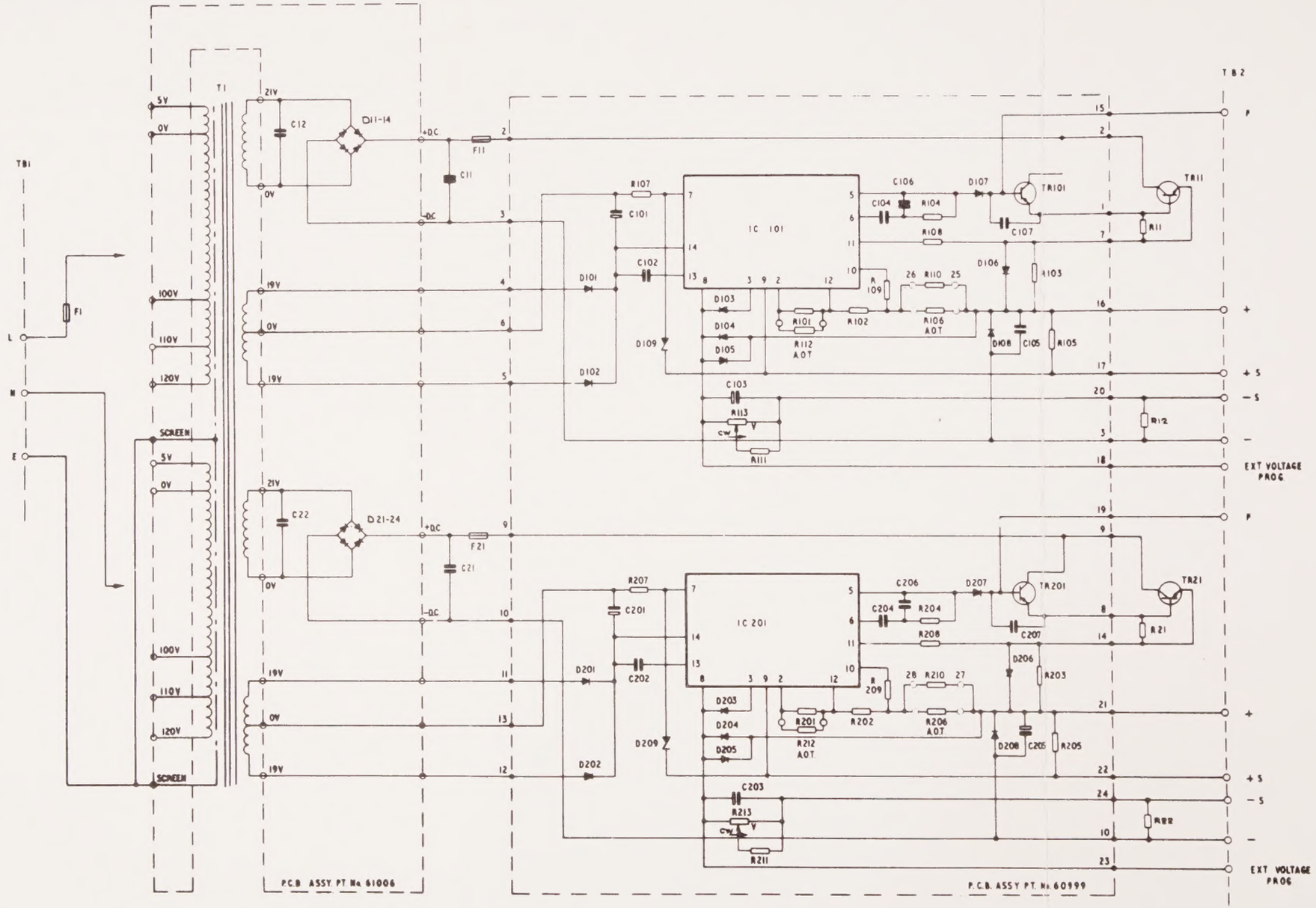
Table 6. Fault finding chart

No Output	Fuse blown	Change fuse
	D11-14 open circuit	Replace with new assembly
	TR11 open circuit	Change TR11
	Control Board faulty	Replace with new assembly
High Output	TR11 short circuit	Change TR11
	Control Board faulty	Replace with new assembly

CCT. REF.	DESCRIPTION	PART No.
F1	STANDARD FUSE Co. C19F SIZE 20×5mm. 1A	53050
F11	STANDARD FUSE Co C19F SIZE 20×5mm 2·5A	53049
F21	STANDARD FUSE Co. C19F SIZE 20×5mm 2·5A	53049
T1	TRANSFORMER	C61787
C11	CAP. ELECT 2200μF 40V	31844
C21	CAP. ELECT 2200μF 40V	31844
TR11	TRANSISTOR STD. POWER	52360
TR21	TRANSISTOR STD. POWER	52360
R11	RES. M.OXIDE 100Ω 2%	26747
R12	RES. M.OXIDE 100Ω 2%	26747
R21	RES. M.OXIDE 100Ω 2%	26747
R22	RES. M.OXIDE 100Ω 2%	26747
P.C.B. CONTROL ASSY. No. 60899		
R101	RES M.OXIDE 9·1K 2%	28799
R102	RES M.OXIDE 18K 2%	50085
R103	RES. W.W. 0·22Ω 5% 6W	4216
R104	RES M.OXIDE 1·2K 2%	26734
R105	RES M.OXIDE 100Ω 2%	26747
R106	RES M.OXIDE	AOT
R107	RES M.OXIDE 100Ω 2%	26747
R108	RES M.OXIDE 1K 2%	27346
R109	RES M.OXIDE 1K 2%	27346
R110	RES M.OXIDE 510Ω 2%	26738
R111	RES M.OXIDE 680Ω 2%	22484
R112	RES M.OXIDE	AOT
R113	RES. RELIANCE CW15 20K	53052
R201	RES. M.OXIDE 9·1K 2%	28799
R202	RES. M.OXIDE 18K 2%	50085
R203	RES W.W. 0·22Ω 5% 6W	4216
R204	RES. M.OXIDE 1·2K 2%	26734
R205	RES. M.OXIDE 100Ω 2%	26747
R206	RES. M.OXIDE	AOT
R207	RES. M.OXIDE 100Ω 2%	26747
R208	RES. M.OXIDE 1K 2%	27346
R209	RES. M.OXIDE 1K 2%	27346
R210	RES M.OXIDE 510Ω 2%	26738
R211	RES. M.OXIDE 680Ω 2%	22484
R212	RES. M.OXIDE	AOT
R213	RES RELIANCE CW15 20K	53052

CCT REF.	DESCRIPTION	PART No.
C101	CAP. ELECT. 100μF 40V.	32189
C102	CAP. M. POLY 0·1μF. 160V	31377
C103	CAP. ELECT. 4·7μF 63V.	32195
C104	CAP. C. DISC 270pF	22380
C105	CAP. ELECT. 150μF 25V.	53054
C106	CAP. C. DISC. 10pF	22364
C107	CAP C. DISC 560pF	22384
C201	CAP. ELECT 100μF 40V	32189
C202	CAP. M. POLY 0·1μF 160 V.	31377
C203	CAP ELECT. 4·7μF. 63V	32195
C204	CAP C DISC 270pF	22380
C205	CAP. ELECT. 150μF 25V	53054
C206	CAP C DISC 10pF.	22364
C207	CAP C DISC 560pF	22384
D101	DIODE IS 923	3560
D102	DIODE IS 923	3560
D103	DIODE IN4148	23802
D104	DIODE IN4148	23802
D105	DIODE IN4148	23802
D106	DIODE IN4148	23802
D107	DIODE IN4148	23802
D108	DIODE IN4003	23462
D109	DIODE ZENER 6·2V	4032
D201	DIODE IS 923	3560
D202	DIODE IS923	3560
D203	DIODE IN4148	23802
D204	DIODE IN4148	23802
D205	DIODE IN4148	23802
D206	DIODE IN4148	23802
D207	DIODE IN4148	23802
D208	DIODE IN4003	23462
D209	DIODE ZENER 6·2V	4032
TR101	TRANSISTOR 2N3053	4039
TR201	TRANSISTOR 2N3053	4039
IC101	INTEGRATED CIRCUIT MC14666	52983
IC201	INTEGRATED CIRCUIT MC14666	52983

CCT REF	DESCRIPTION	PART No.
P.C.B. TRANSFORMER ASSY. No. 61006		
C12	CAP. M. POLY 0·1μF. 160V.	31377
C22	CAP. M. POLY 0·1μF. 160V.	31377
D11	DIODE IN4003	23462
D12	DIODE IN4003	23462
D13	DIODE IN4003	23462
D14	DIODE IN4003	23462
D21	DIODE IN4003	23462
D22	DIODE IN4003	23462
D23	DIODE IN4003	23462
D24	DIODE IN4003	23462



ADJUST ON TEST PROCEDURE
R112 } WITH AMMETER CONNECTED BETWEEN NEGATIVE SENSE AND
R212 } NEGATIVE OUTPUT ADJUST R112 OR R212 TO GIVE 1mA. ± 2%.
R106 } ADJUST R106 OR R206 TO GIVE 1·05A ± 2% O/P CURRENT.
R206 }

Fig. 10 Circuit Diagram

GUARANTEE AND SERVICE FACILITIES SECTION 7

This instrument is guaranteed for a period of one year from its delivery to the purchaser covering the replacement of defective parts other than semiconductors and fuses. Semiconductors are subject to the manufacturer's guarantee.

We maintain comprehensive after sales facilities and the instrument can, if necessary, be returned to our factory for servicing. The type and Serial Number of the instrument should always be quoted, together with full details of any fault, and the service required. The Service Department can also provide maintenance and repair information by telephone or letter.

Equipment returned to us for servicing must be adequately packed, preferably in the special box supplied, and shipped with transporation charges prepaid. We can accept no responsibility for instruments arriving damaged. Should the cause of failure during the guarantee period be due to misuse or abuse of the instrument and if the guarantee has expired, the repair will be put in hand without delay and charged unless other instructions are received.

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